

The Plum Pollination Predicament

Japanese plums are a significant export crop in South Africa. *Prunus salicina*, originated in China, before it was cultivated in Japan, and later introduced to the USA where it was interbred with indigenous diploid plums to improve important fruit and tree qualities. What is therefore commonly referred to as Japanese plums (or locally simply as plums), is actually a heterogeneous group derived from various species. Most, however, share the trait of not being able to self-pollinate inhibiting self-fertilisation, and requiring a pollinator to set fruit, and indeed the best possible cross-pollinator in a commercial environment to produce profitable yields.

A PROVAR INITIATIVE

Provar an independent fruit cultivar and rootstock evaluation company, provides services that support the client's product development activities. Provar is constantly looking for means to apply fresh technology and the latest techniques to generate and distribute valuable information with regards to new cultivars. Near the end of last year Provar endeavoured to provide some clarity to the question of cross pollinators for clients in the plum industry, focusing on newly released cultivars under evaluation.

WHY DID PROVAR GET INVOLVED?

In recent decades, the bulk of the plums produced locally have been from locally bred cultivars, however, plum breeding is progressing at a fast pace and the local cultivars now compete with a multitude of imported varieties. With the wide host of new cultivars on offer to the market, many producers are opting to diversify their product ranges.

With the roll out of new plum cultivars, poor fruit set has occurred in many orchards, in

many cases presumed to be due to a poor choice of cross pollinator. A problem that has been exacerbated, and indeed echoed in more traditional plantings by shifts in climate that have led to flowering times of the main cultivar and the cross pollinator being out of sync. The determination of cross pollinators in the past have been more of a hit-and-miss strategy, relying on flower time overlaps and then seeing if it actually affects fertilisation and fruit set.

Today we have a better understanding of the molecular and biochemical mechanisms involved, and can test for genetically compatible pollinators, before going to the field. The mechanism of incompatibility is an outcome of the S-locus within the plum genome that encodes two linked genes. Because plums are diploid, each cultivar carries two versions of the linked genes called alleles. Cloning and characterising these alleles have led to the development of molecular methods that enable S-allele typing of Japanese plum cultivars. Although many cultivars have been genotyped during the development of these molecular tools, the South African industry have not yet reaped the benefits of this technology.

PROVAR'S CHOICE TO ACTION

During the past season Provar tested over 30 cultivars from various local IP managers against a panel of common cross pollinators and commercial cultivars, enabling them to refine their recommendations of suitable cross pollinators for their producers.

To determine the S-alleles in the tested cultivars, consensus primers that were designed for automated detection (Guerra et al., 2012; Vaughan et al., 2006; Sonneveld et al., 2006) were used. Leaf

samples were collected or received from October 2016, processed, and submitted for PCR amplification with the chosen primer sets and according to the conditions described in Guerra et al. (2012). The data was analysed, and genotypes assigned, and subsequent genetic compatibility determined.

A simplified view of some of the results can be seen in Table 1. For a cultivar to successfully act as a cross pollinator, it needs to carry at least one different S-allele to the main variety (semi-compatible), or preferably two different S-alleles (fully-compatible). If two cultivars both carry the same two S-alleles, they are incapable of fertilising each other.

WHAT CLIENTS LEARNED

The data shared with clients were extremely well received. In subsequent discussions where flowering times were taken into account for different climatic regions, recommendations could be generated for suitable cross pollinators or pollinator combinations for cultivars by Provar.

The benefits of this initiative can now be filtered through to the producers, raising the potential of success of new plantings, and new cultivars.

PROVAR'S OFFER

Provar offers a range of evaluation services as well as supplementary services, for example, on the molecular front, in addition to the S-allele testing we have started work on genetic fingerprinting to establish trueness-to-type where questions of authenticity have arisen.

We see our clients as "Evaluation Partners", complementing their in-house evaluation and product development through a set of services that verifies the commercial potential of new cultivars and minimises planting risk for producers.

If the adage stands, that knowledge is power, then the Provar initiative aims to improve the

collective knowledge on new cultivars, and empower better decision making around plantings throughout the SA fruit industry.

Visit Provar at their fruit evaluation laboratory in Zandwyk Park, Paarl and visit us at provar.co.za.

**For more information, contact Carl Hörstmann
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*Table 1. An example table indicating the genetic compatibility relationships within an average flowering window of selected cultivars. A green square indicates full compatibility, a yellow square indicates semi-compatibility, and a red square with an X indicates non-compatibility. *'African Rose', 'Harry Pickstone', and 'Pioneer' all carry a self-compatible mechanism and is theoretically at least semi-compatible with most plum cultivars.*

CULTIVAR	Week	African Rose*	Pioneer*	African Delight	Harry Pickstone*	Fortune	Ruby Sun	Sapphire	SunKiss	Ruby Crunch	Songold	Ruby Star
		34/35	35	35	36/37	36/37	36/37	36/37	37/38	37/38	38/39	39
African Rose*	34/35	-	-	-	-	-	-	-	✓	-	✓	-
Pioneer*	35	-	-	-	-	-	-	-	✓	-	✓	-
African Delight	35	-	-	✗	✓	✓	✓	-	-	-	-	-
Harry Pickstone*	36/37	-	-	✓	-	-	-	-	✓	✓	-	-
Fortune	36/37	-	-	✓	-	✗	✗	-	-	-	✓	✓
Ruby Sun	36/37	-	-	✓	-	✗	✗	-	-	-	✓	✓
Sapphire	36/37	-	-	-	-	-	-	✗	✓	-	✓	-
SunKiss	37/38	✓	✓	-	✓	-	-	✓	✗	-	-	✓
Ruby Crunch	37/38	-	-	-	✓	-	-	-	-	✗	✓	-
Songold	38/39	✓	✓	-	-	✓	✓	✓	-	✓	✗	-
Ruby Star	39	-	-	-	-	✓	✓	-	✓	-	-	✗